

Development of a Global Hydrographic Climatology with High Quality Arctic Data

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Grant #: N00014-99-1-0054

<http://psc.apl.washington.edu/Climatology.html>

LONG-TERM GOAL

The goal of this project is to develop a global ocean climatology that contains a high quality representation of the arctic seas for use in PIPS (and other) model development. Our product is called the Polar science center Hydrographic Climatology, or PHC.

OBJECTIVES

Our objective is to assist in the development of PIPS 3.0, the next generation Navy operational polar model. Specifically, we propose to develop a gridded oceanic data set that will be uniquely suited to this model. It will consist of global temperature and salinity fields using new Russian and Western arctic data that can be used for model initialization, restoring, and validation.

APPROACH

Our approach is to merge two data sets: (1) The Arctic Ocean Atlas (AOA) produced by the Environmental Working Group (EWG, 1997, 1998) in which formerly classified Russian and Western data have been gridded into fields for the Arctic Ocean and Nordic Seas, and (2) the World Ocean Atlas, 1998 version (WOA98; *Antonov et al.*, 1998; *Boyer et al.*, 1998) produced by the National Oceanographic Data Center (NODC) under the leadership of S. Levitus, which includes data from many sources into a global product. NODC does not have access to the original Russian data that are included in the AOA, and thus the Arctic Ocean fields in WOA98 are not as reliable. We merged AOA and WOA98 temperature and salinity fields using optimal interpolation. The AOA data were assigned lower error in the Arctic regions than the WOA data. The opposite was true in the Nordic Seas, as we found that the WOA reproduced the strong exchanges of Atlantic and Arctic waters more accurately than the AOA. Our result is a global product that includes a state-of-the-art representation of the Arctic Ocean. It provides the first comprehensive view of waters as they move from the North Pacific, through Bering Strait into the Arctic Ocean, and then out the Canadian and Eurasian straits into the Northwest and Northeast Atlantic Ocean. The product is interpolated onto the exact same grid as the WOA98 product and in the exact same format, making it easy for current WOA users to use our new PHC product. M. Steele is responsible for guiding the research; W. Ermold is the programmer who runs the merging and graphics analysis software.

Report Documentation Page			Form Approved OMB No. 0704-0188		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE SEP 2000		2. REPORT TYPE		3. DATES COVERED 00-00-2000 to 00-00-2000	
4. TITLE AND SUBTITLE Development of a Global Hydrographic Climatology with High Quality Arctic Data			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Applied Physics Laboratory,,1013 NE 40th Street,,Seattle,WA,98105			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 4	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

WORK COMPLETED

The first version of PHC merged the Environmental Working Group (*EWG*, 1997, 1998) and WOA94 (*Levitus and Boyer*, 1994) climatologies. In the past year, we have completed transition of this product to PIPS modelers, who are using it for model initialization, climate restoring, and validation. Several dozen other modeling centers are also using this product.

Early in 2000 a new WOA98 data set was publicly released. It contains more data and uses an improved interpolation algorithm relative to the 1994 version. During this past year we thus updated the PHC using this new product. We also improved the PHC interpolation algorithm. The new PHC is now publicly available. We are also updating the PHC web site (<http://psc.apl.washington.edu/Climatology.html>) to reflect these changes.

We have a paper in press at the Journal of Climate (*Steele et al.*, 2000) that describes the new version of PHC. In addition, we have presented this material at several national and international meetings and workshops.

RESULTS

We are using the PHC actively in our research. For example, we are using it as "ground truth" in the Arctic Ocean Model Intercomparison Project (AOMIP), an international cooperative project funded currently by the International Arctic Research Center. We are comparing model output from a variety of centers (including the Naval Postgraduate School) and determining where the models agree and where they disagree with the observations as represented in part by the PHC.

IMPACT/APPLICATION

The use of a good climatology should reduce the magnitude of the artificial "climate restoring" term needed in PIPS. This seems to be the case, but we need to investigate further. The ultimate goal is to eliminate this term completely, which will involve solving the outstanding mystery in the entire community as to why most models need this term to accurately simulate a PHC-like mean state.

TRANSITIONS

PIPS modelers have been using the first version of our PHC that included the WOA94. We will be assisting soon with the transition to the newer PHC that includes WOA98.

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PUBLICATIONS

Steele, M., R. Morley, and W. Ermold, PHC: A global ocean hydrography with a high quality Arctic Ocean, *J. Climate*, in press, 2000.